

French Transportable Laser Ranging Station

Chronometry accuracy estimation

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Towards zero bias...



*FTLRS in Chania (Creta)
Gavdos campaign - 04 to 10 2003 -*



laser maintenance



*FTLRS in San Fernando (Spain)
June 2004*



GEMINI - FTLRS staff

What conditions?

- ▶ Very short time intervals: (internal cal. < 30 ns)
- ▶ External calibration: (100 m to 300 m)
- ▶ For satellites tracking: (400 km to 10 000 km)
- ▶ Time evolution (long-lasting effect)

How?

With two timing systems:

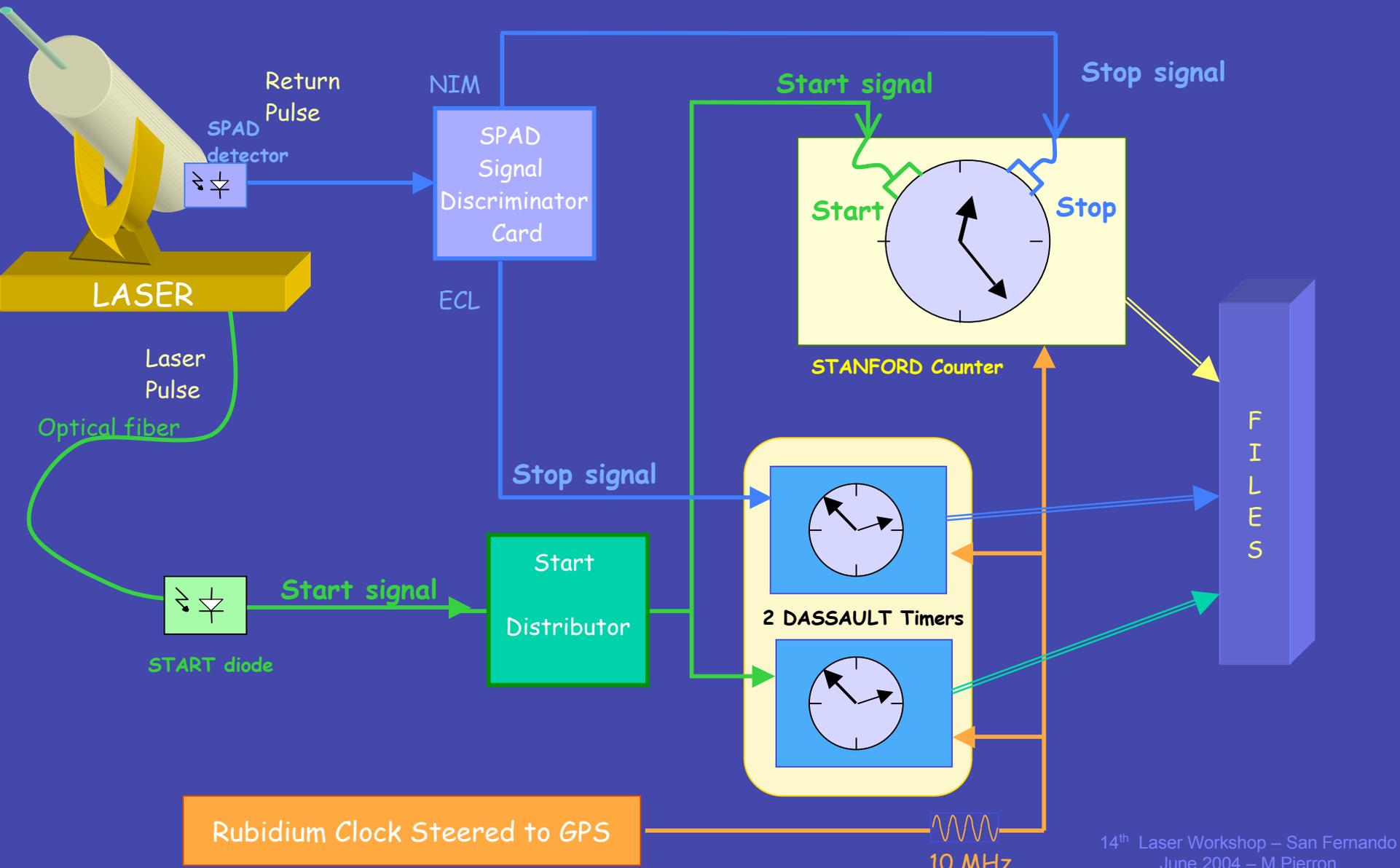
- ▶ FTLRS Stanford chronometer (temperature controlled)
- ▶ Dassault Timers as a reference

In same Context :

Laser for start
Photodiode for stop
Without mutual perturbation

On same events :

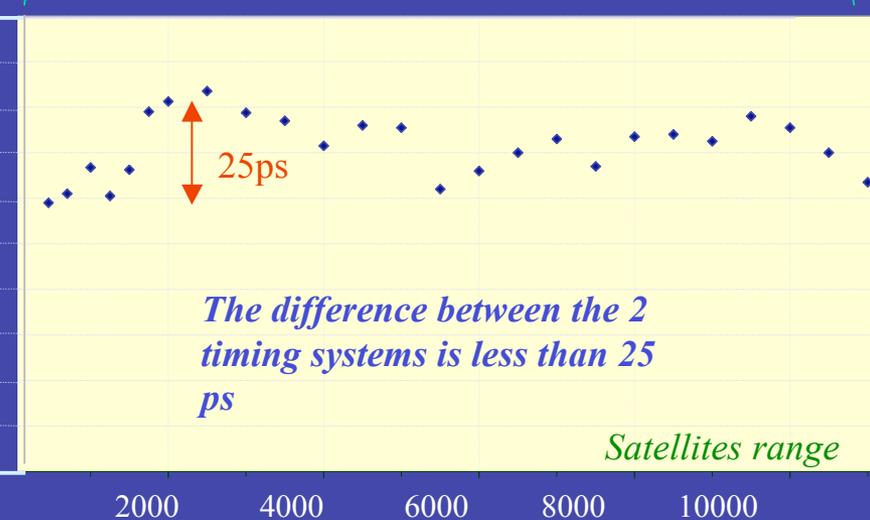
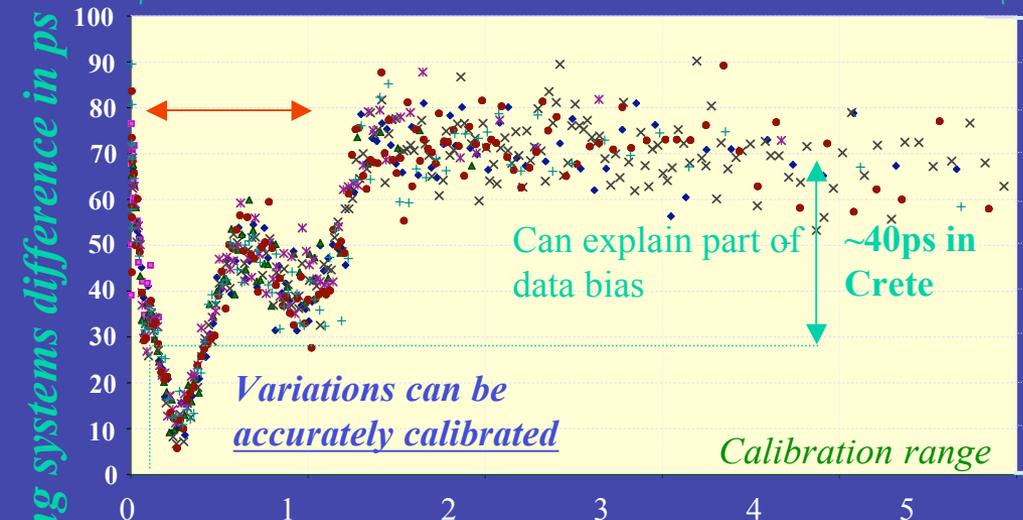
Echo or noise



Measurement results

0 to 5 km

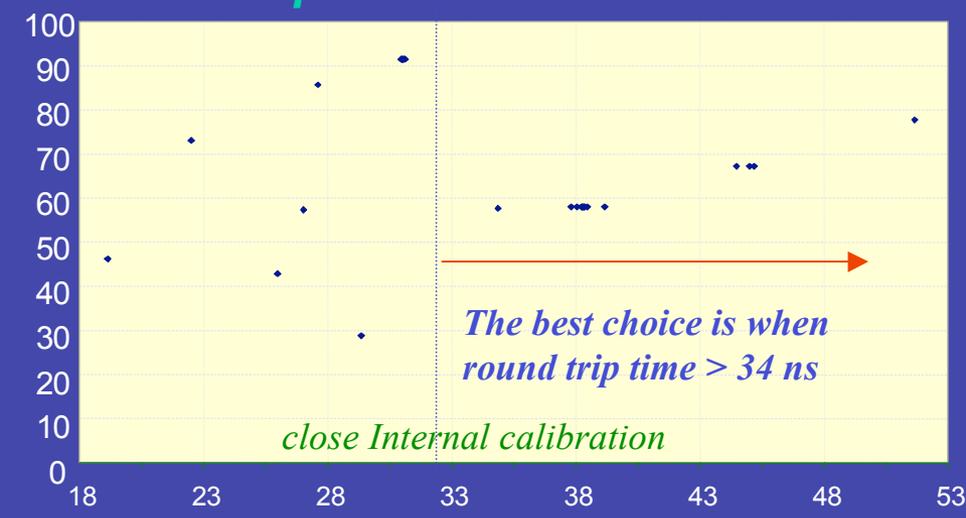
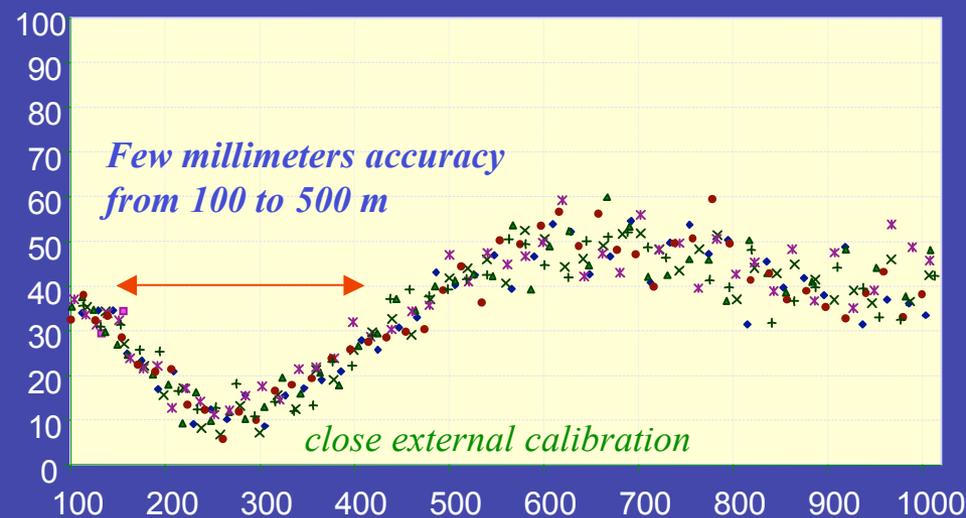
400 to 10 000 km



All this measurements are NOT time dependant

From 100 meters to 1 km

Roundtrip time from 15 to 55 ns



CONCLUSION

Very important to model the chronometry behavior at different ranges, and to process the calibration value accordingly.

➤ Stanford Chronometer can achieve *few millimeters accuracy during satellites tracking* (from 400 to 10 000 km).

➤ Range near external calibration is easy to model. *The correction to achieve for this external calibration can be tuned to 30/60 picos depending on the target's range.*

➤ Values near internal calibration range are more difficult to evaluate, except when the roundtrip time is longer than 34 nanos. *The difference between external and internal calibrations is about 50 picos (7.5 mm).*